

REMARKS

Claims 1-17, as amended, are pending in the present patent application.

Substitute drawings are submitted for Figures 1 and 2 which now include a notation that these drawings depict the prior art. The entry of these drawings would be appreciated. It should be recognized, however, that the methods illustrated in those FIGS. do form part of the methods of the present invention are also novel to the extent that they are practiced in the present methods.

Claims 1, 3-10, and 12-16 were rejected under 35 U.S.C. 102(b) as allegedly being anticipated by Goesele et al. U.S. Patent No. 6,150,239 ("Goesele"). Applicants again traverse this rejection.

Before addressing the rejection, a summary of the invention is provided to emphasize the novel and inventive features of the presently claimed method. Please note that numbers in brackets [] refer to the paragraphs of the published application (US2004/0248378).

The present application in [005] relates to a method for obtaining a thin SOI-like structure. The method includes thinning a transferred useful layer of an initial structure by detaching part of this useful layer ([005], [0013] and [0047]). The initial structure comprises a relatively thicker useful layer that has been transferred onto a first support substrate from a different donor or source substrate.

It has been found that it is sometimes difficult to transfer high quality thin layers. This problem is now solved by transferring a high quality thicker layer onto a first substrate and then thinning it by removing material. This is preferably accomplished by removing a part of the high quality thicker layer by the so-called SMART-CUT® layer transfer process. The final product is then a relatively thinner high quality layer on the first substrate with the quality being equivalent to that one obtained when transferring thicker layers using SMART-CUT® or other processes.

An important feature of the invention ([0013]) is to recognize that, in the SMART-CUT® process, implantation produces a zone of weakness which defines a cleaving plane. However, the location of the cleaving plane is not precisely at the middle of the zone of weakness, but instead it is located deeper in the substrate, with the result that a portion of the zone of weakness will be present in the transferred layer rather than in the source substrate. This portion of the transferred layer limits the thickness and quality of the useful layer that can be formed. This is

because that portion is generally removed by additional treatments such as polishing or sacrificial oxidation, and those treatments can deteriorate the uniformity or defectivity of the transfer layer.

This problem is solved in the present invention by first forming a structure comprising a rather thick useful layer, using a layer transfer method, on a support substrate of a different material, and then using this structure in effect as a source substrate, i.e., the successive steps of implantation, bonding and layer transfer are conducted on this thick layer. The final product of this process will be the previous support substrate with the thinner useful layer (from which a certain thickness has been detached and transferred). The cleaving plane in the zone of weakness formed that is formed during the implantation step will be located rather deeper in the relatively thick layer, such that after detachment, the portion that is transferred with the transfer layer is minimized, resulting in a thicker useful layer.

In contrast, Goesele describes the transfer of thin layers from a first substrate to a second one to form a final semiconductor structure, according to the usual SMART-CUT® transfer process technology. The initial substrate providing the second useful layer in Goesele is a first substrate (col. 4, lines 6-12) which could be a bulk monocrystalline material, a layered monocrystalline substrate structure, for example with at least one epitaxial layer, thin polycrystalline surface layers, or an amorphous surface layer. None of these different structures relate to that which is used in the present invention, namely an initial substrate having a transferred layer on a support.

While Goesele's first substrate may include a multilayered structure, this entire structure is transferred so that the remaining substrate does not include a useful layer on a substrate of a different material. Goesele's first substrate is merely a source of a layer or layers to be transferred but is in no way a final substrate. Thus, a transferred layer bonded to the initial substrate is not obtained in Goesele's process, nor is at least a pair of semiconductor structures produced wherein each includes at least one transferred useful layer on a substrate.

In the present invention, it is well explained that the first useful layer is bonded to the initial substrate, preferably by a SMART-CUT® transfer process:

paragraph [0024] describes the useful layer of the rank structure 1 obtained by a layer transfer technique

paragraph [0030] describes the same process to obtain the second useful layer from the initial substrate via a bonding step

the thinning of the first useful layer is described in the paragraph [047] using the preferred SMART-CUT® process.

Claim 1, therefore, is directed to a method for concurrently producing a pair of semiconductor structures that includes, among other features, the process of "providing an initial structure that includes a relatively thick, transferred useful layer having a front face bonded to a final support substrate." Claim 1 has been amended to clarify the relative thickness between the initially transferred layer and subsequently transferred layers, and to emphasize that it is the final support to which the relatively thicker transferred layer is bonded. These features are supported by the previously mentioned paragraphs so that there is no issue of new matter in entering these changes.

As such, the present method provides an initial structure that includes a relatively thick, transferred useful layer that is bonded to a final support substrate prior to further processing of the initial structure. As noted, Goesele does not describe such a feature and does not describe or suggest all the features of claim 1. Thus, claim 1 and its dependencies are not anticipated by Goesele.

Furthermore, Goesele does not mention the thickness of the layer on the first substrate after the transfer of the monocrystalline thin layer onto the second substrate. Nor does he disclose implanting atomic species into the transferred useful layer. As previously explained, the aim of the invention is to obtain a very thin useful layer without defects on the initial substrate ([0047] and [0048]) while Goesele is directed to the conventional transfer of one layer onto a different substrate.

In order to avoid any possible confusion over the interpretation of the term "bonded" to cover any material that is deposited onto a substrate, applicants have clarified claim 1 by adding the term "transferred" as supported by [0030]. This further distinguished the present invention from Goesele (see col. 3, lines 3-12).

The office action includes certain statements that one of ordinary skill in the art would recognize as not being correct. For example, applicants have explained why the claimed step of "providing an initial structure that includes a useful layer having a front face on a support

substrate" is not present in Goesele. The main difference remains in the nature of the term "initial substrate". In Goesele, the initial substrate is clearly described as a support of a bulk material, a layered monocrystalline substrate structure ... (col. 4, lines 3-12). This corresponds to the source substrate of the present invention, which substrate is then used for preparing the initial substrate of claim 1 (see [0020] to [0030]).

Also, while a step of "implanting atomic species into the useful layer to controlled mean implantation depth to form a zone of weakness within the useful layer that defines first and second useful layers" is disclosed in Goesele, he uses such a step in into a first substrate to define the upper portion which corresponds to a future layer to be transferred. In contrast, in the present invention, the implantation is made into a relatively thick transferred useful layer on a final substrate to form a zone of weakness which is cleaved to subsequently transfer part of this layer to another substrate. Goesele does not describe such a "second" implantation into a first substrate (corresponding to the source substrate of the invention, which does not have a transferred layer bonded with the support substrate) to define a layer to be transferred (col.4, lines 24-33).

And while bonding and detaching steps are disclosed in Goesele, again these are conducted on an initial source substrate and not on a layer that has been transferred to a different substrate. In the present invention, this results in two useful layers: the one that remains on the substrate that received the implantation into the relatively thicker useful layer and the second substrate that has received that part of the thicker layer after bonding and transfer. This can also be repeated (see present claims 3-6). In Goesele, there is only one transferred layer: the remaining portion of the first substrate does not include a support and instead corresponds to the source substrate of the present invention.

The different passages in Goesele cited in the office action (e.g., col.1, lines 22-24, col.3 lines 25-28, and col.4 lines 40-44) involve the use of the first or source substrate from which a transfer of a useful layer is made and to the reuse of this first substrate. In the invention, the initial structure is used to form a first rank structures which are then used to form other optic, electronic or optoelectronic structures ([0030] to [0034]). The source substrate does not need to be reused since it is the relatively thick transfer layer that provides the additional transfer layers. Accordingly, all claims based on Goesele alone have been overcome and should be withdrawn.

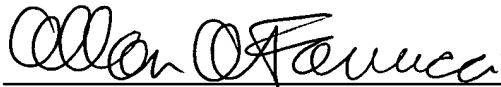
Claims 2, 11 and 17 were rejected under 35 U.S.C. 103(a) as being unpatentable over Goesele in view of Abe EP 1174926 A1 and Joly . All the features of claims 2 and 11 are not described or suggested by Goesele, Abe and Joly, at least because claims 2 and 11 depend from a base claim that is allowable.

The basis behind this rejection is also incorrect. As noted above, Goesele does not teach the presently claimed process and neither Abe or Joly teach that a substrate of a relatively thick useful layer on a support of a different material could be use to provide a portion of the useful layer for transfer to another substrate. Thus, even if these references are combined as suggested, one does not obtain "a relatively thick useful layer having a front face bonded to a final support substrate". Thus, the rejections based on these three references has been overcome and it also should be withdrawn.

Accordingly, it is believed that the entire application is in condition for allowance, early notice of which would be appreciated. Should the Examiner not agree, then a telephonic or personal interview is respectfully requested to discuss any remaining issues and expedite the eventual allowance of the claims.

Respectfully submitted,

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